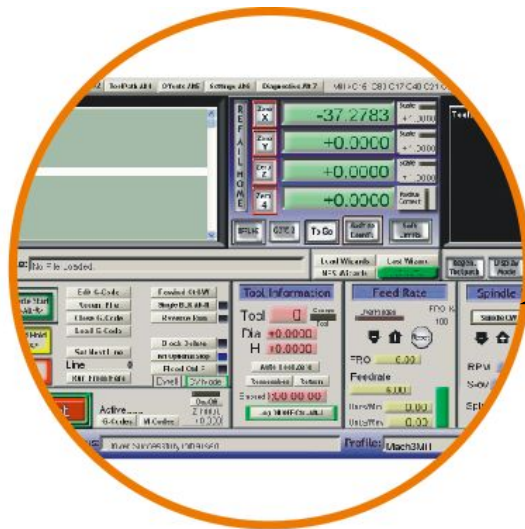
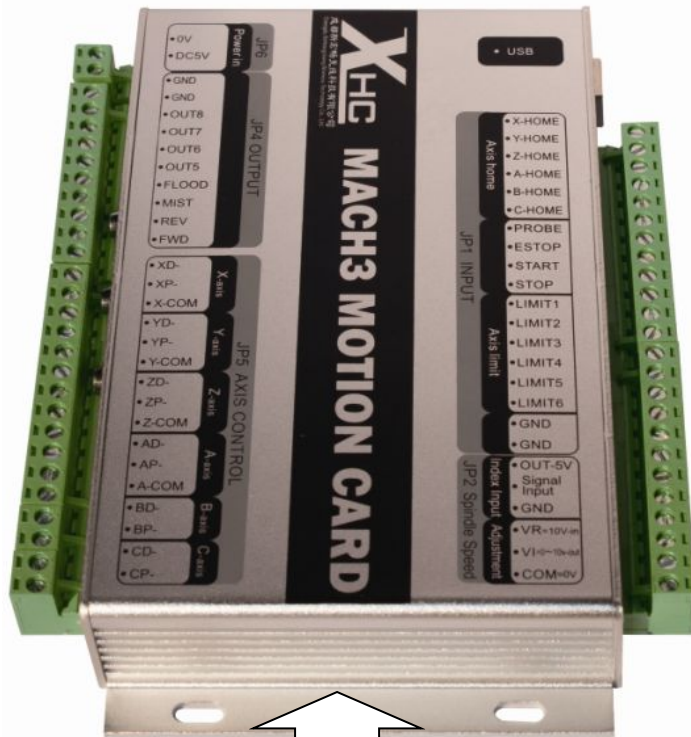


## MAC3-USBCARD-MK-Instructions

**Suitable systems: MACH3**

**Model: XHC-MK4: With USB interface, 4-axis motion control card**

**XHC-MK6: With USB interface, 6-axis motion control card**



**MACH3**

**Features:**

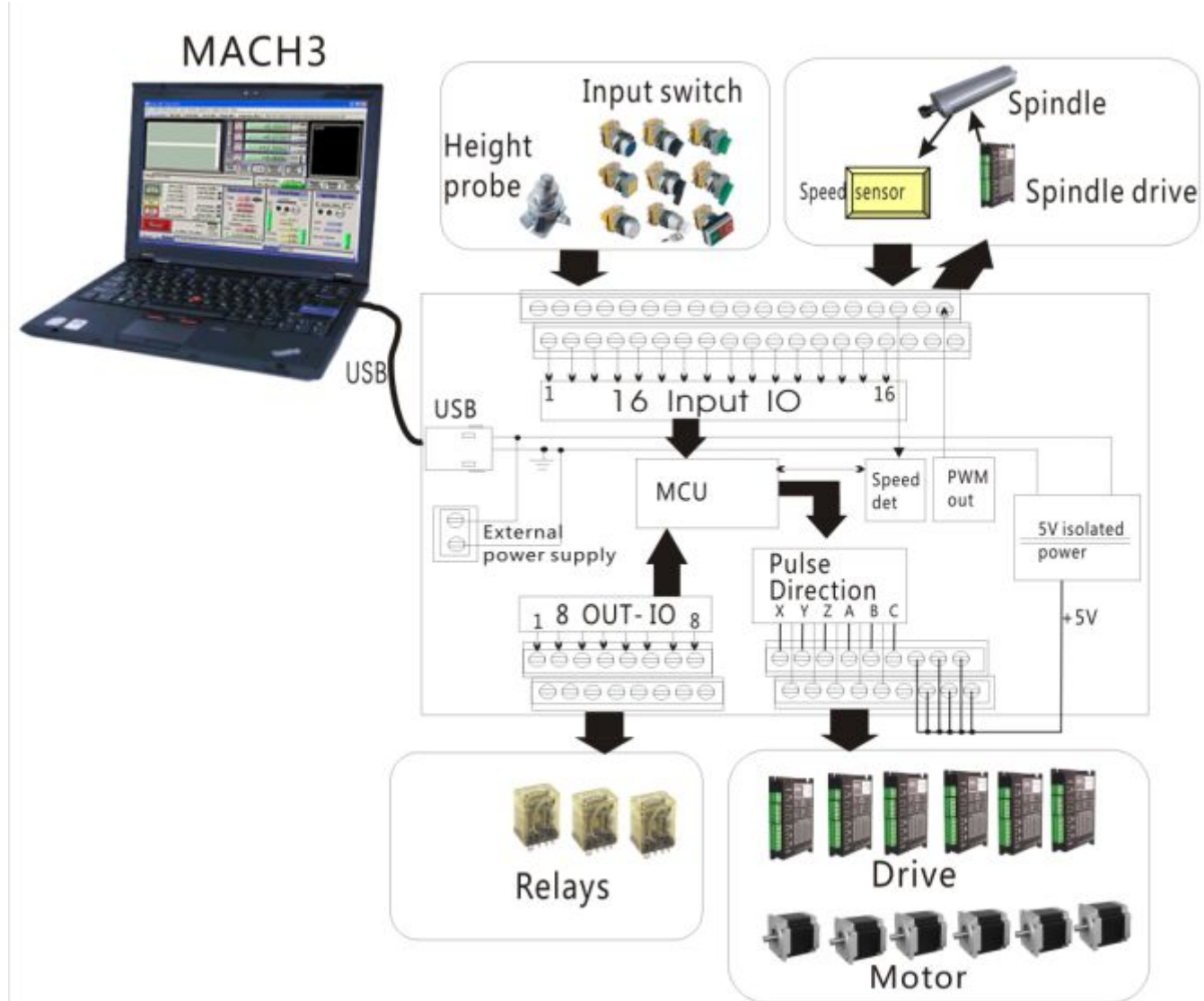
- ✧ Fully supporting all Mach3 versions
- ✧ Full support for USB hot-swappable, the card is Monitoring USB connection status at any time.
- ✧ Supports 6-axis
- ✧ Maximum step-pulse frequency is 200KHz
- ✧ Status indicator LED can be useful to show the USB connection, and working status by flashing.
- ✧ 16 general-purpose input
- ✧ has speed function, the spindle actual speed Mach3 interface in real-time display
- ✧ has onboard isolated power supply, no external power supply
- ✧ all IO-port isolation, interference, stable performance
- ✧ Support WHB04 wireless MPG

**Revisions List**

Date/ver	Info
2011-12-10 Ver1.00	The first version released IO port control PWM control, spindle speed adjustment
2012-4-3 Ver1.08	Continuous processing to solve the instability occurs
2012-8-2 Ver1.12	Wireless MPG function
2012-10-22 Ver1.16	6 axis function
2013-4-18 Ver2.10	Plasma cutting system applications interference problems
2013-07-27 Ver2.21	Spindle PWM speed control output; support spindle pulse + direction output; supports the 0 to 10V analog voltage output.

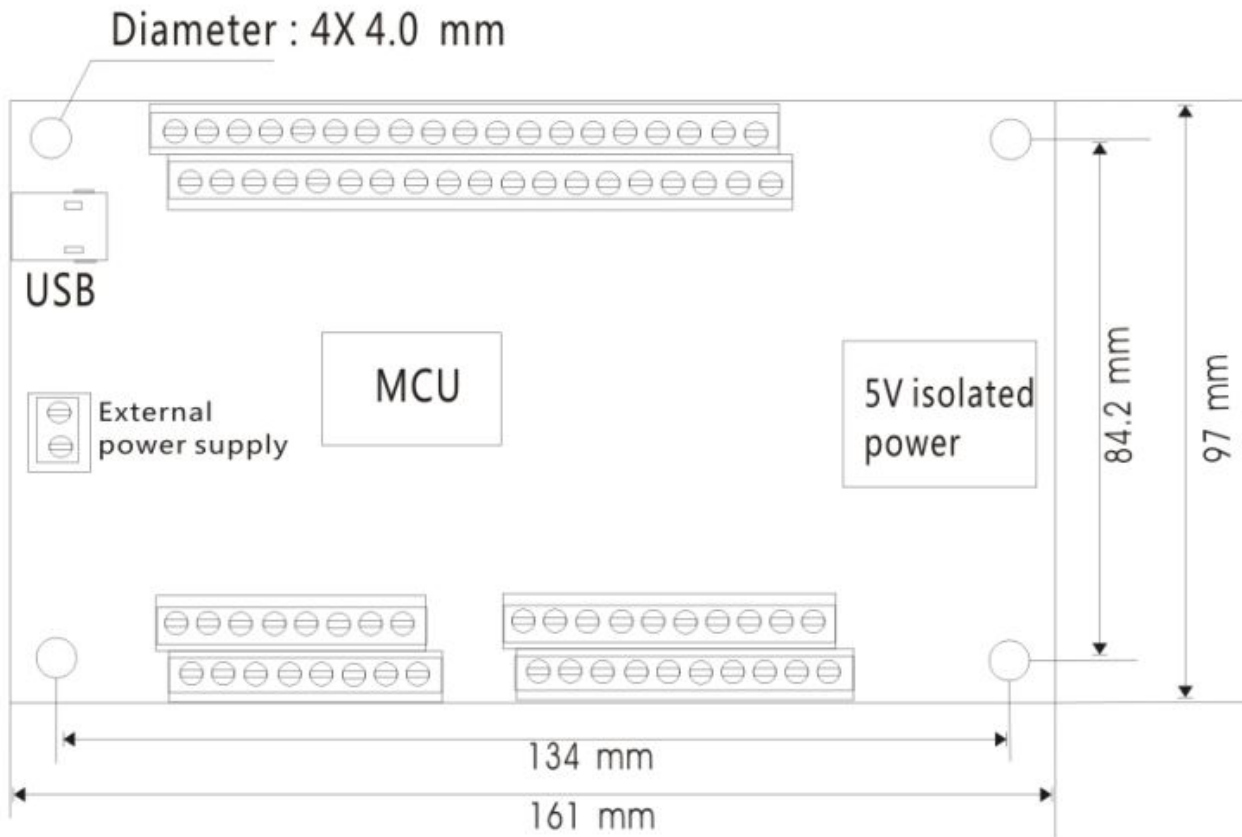
## 1. Simple connection description

### 1. 1 Application Connection Diagram



Support: 6-axis or 4-axis

## 1. 2 Motion control card Dimensions



## 1. 3 Electrical Characteristics

	Parameter Description	
axis output control	Drive Current	Isolated open collector output; 5V, 20mA
	Drive	Pulse + direction output
	Output frequency	200KHZ
	axes	MK4: 4-axis; MK6: 6-axis
	Isolation Voltage	3. 5KV
Spindle inverter output	Analog voltage output	0—10V
	PWM output	5V, 2KHZ, Duty; 0-100%
	Pulse + direction output	5V, 15HZ to 400HZ
Spindle speed input	Input	Isolated input, 5V pulse signal
	Isolation Voltage	3. 5KV
8 IO output	Drive Current	Isolation : 50mA, 25V
	Isolation Voltage	3. 5KV
16 IO input	Input Current	Isolated inputs, 5 mA, maximum voltage 25V

	Isolation Voltage	3. 5KV
USB interface	Complies with USB2.0 standard	

## 2. Preparing for Installation

### 2. 1. Mach3 software ready



This card is a Mach3 USB interface 4/6-axis motion control card external.



The latest version of Mach3 official website:

<http://www.machsupport.com/downloads.php>



Mach3 download: as shown below:



## Downloads

For previous versions of Mach and LazyCam, XML's, and other Extra Information: [Click Here](#)

(Some of the older files are linked directly from the FTP server in order to avoid redundancy. If your download does not start immediately, please give it a few seconds - it's probably trying to contact/login to the FTP server.)

## Mach

Mach3 is the flagship of the ArtSoft products. It is released in two versions: a Lockdown version, and a Development version. The Lockdown is a stable, static release recommended for new users, or people trialing the software. The Development version contains developing features and is released quite often so people can obtain new (but untested) features and capabilities. Both releases are limited to 500 lines of Gcode until licensed. Mach3 has a limit of 10,000,000 lines of Gcode even after licensing.

\*You must use a Desktop PC running a 32-bit version of Windows if you are using the Mach3 Parallel Port Driver. Laptops are not supported because the power saving features of the chipsets disrupt the pulse stream. Mach3 will only be supported on laptops running an external motion controller, such as one of those found on the [Plugins](#) page.\*

Lockdown:

[Mach3 R3.042.040](#)

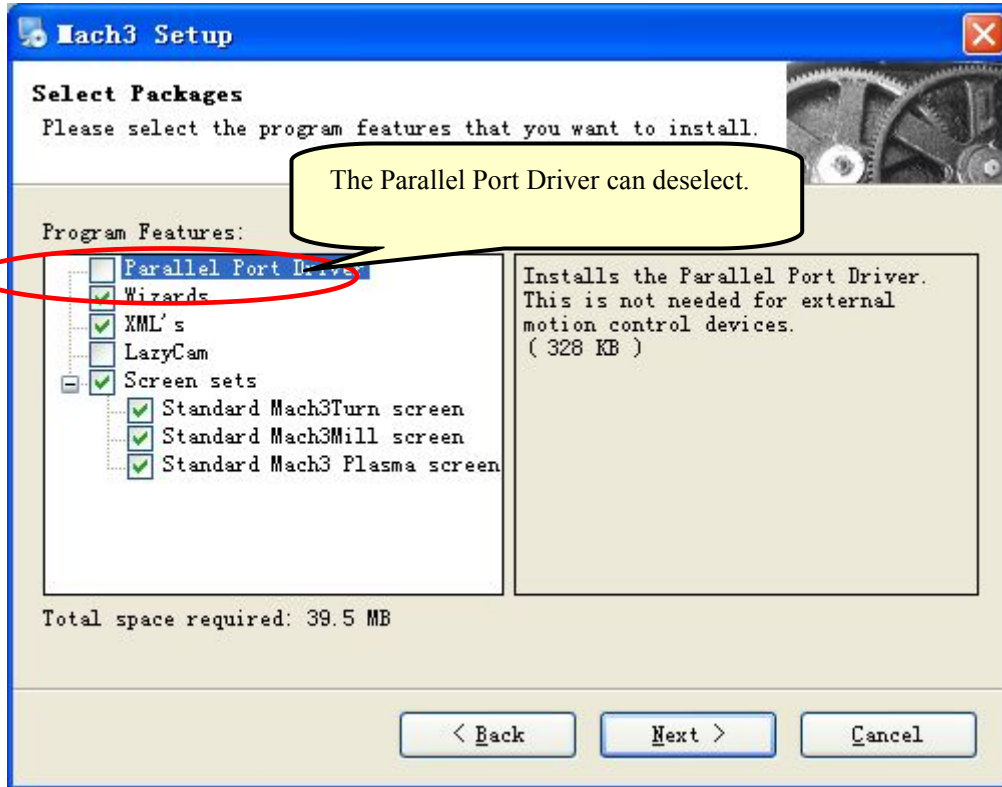
[Mach3 Changelog](#)





Installation the Mach3:

The Parallel Port Driver does not require.



## 2. 2. USB cable Prepare

Magnet ring installed in the USB cable at both ends



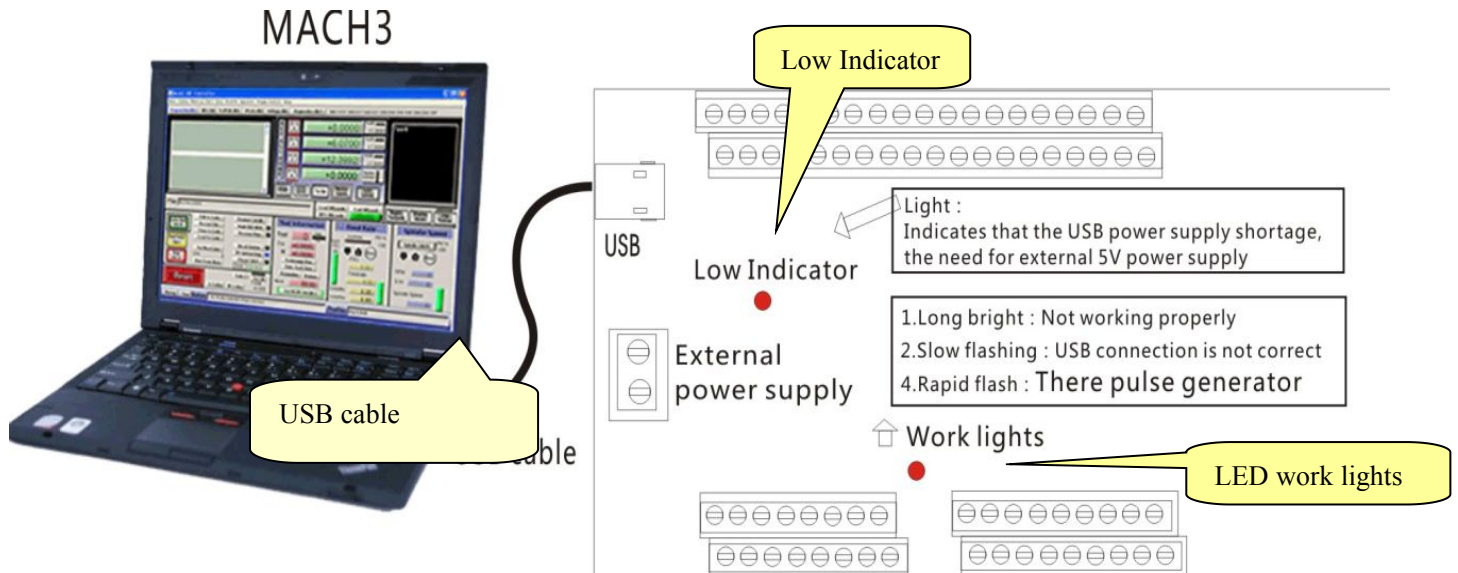
**Attention**

Use of acceptable quality USB cable

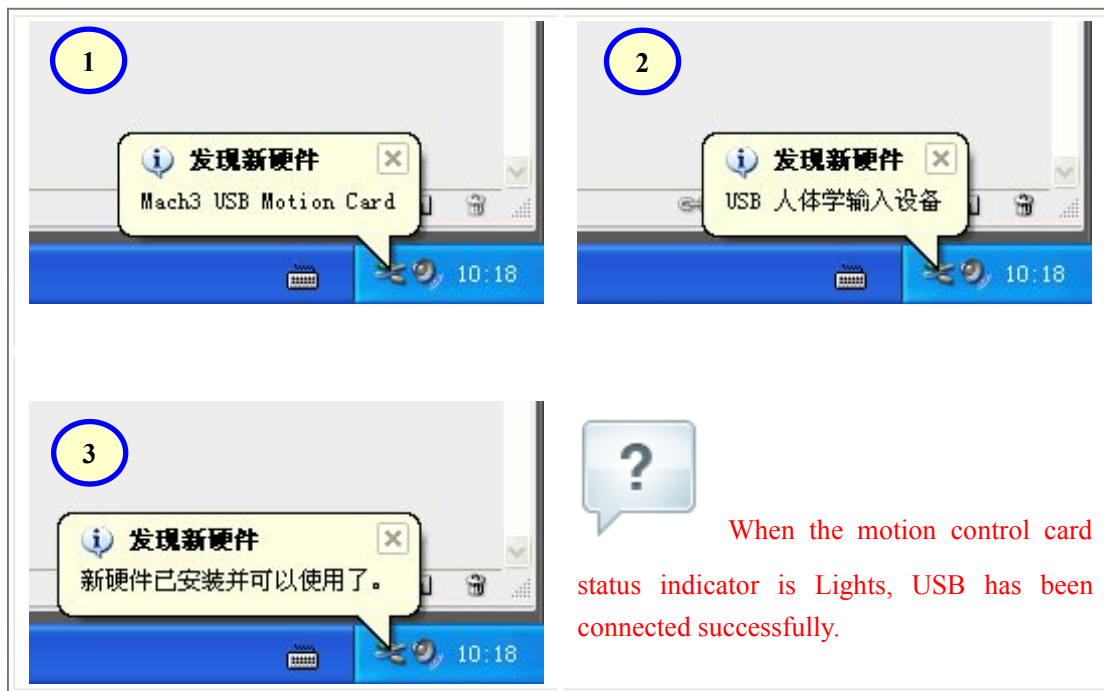


## Motion control card software installation

### 1. USB cable connected to the PC



Connect the USB cable on the card, it will automatically install the driver. Wait for the indicator light, you can work. As shown below :





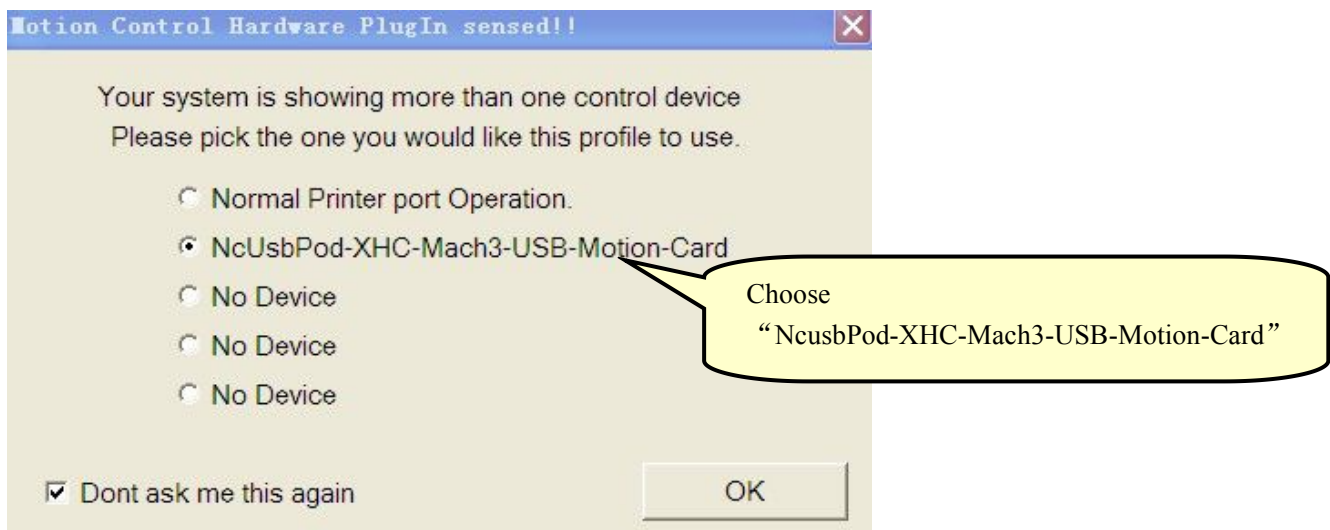
## 2. Install plug MACH3

Installing the motion card plug-in. Unzip the NCusbPod.zip, copy or drag NCusbPod.dll into your Mach3\PlugIns folder.



## 3: Select pulse output

Start Mach3 software, Choose "NcusbPod-XHC-Mach3-USB-Motion-Card", Choose "Don't ask me this again"



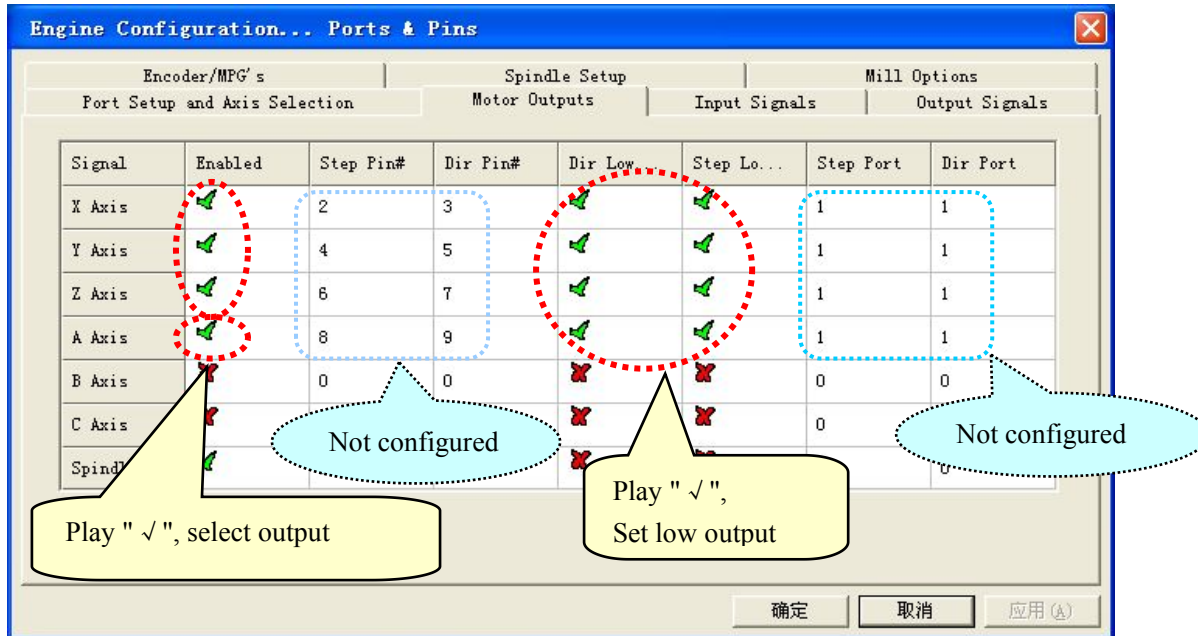
When the LED flashes on the card, which means that the card is already connected with a USB MACH3 completed..



## Mach3 software configuration

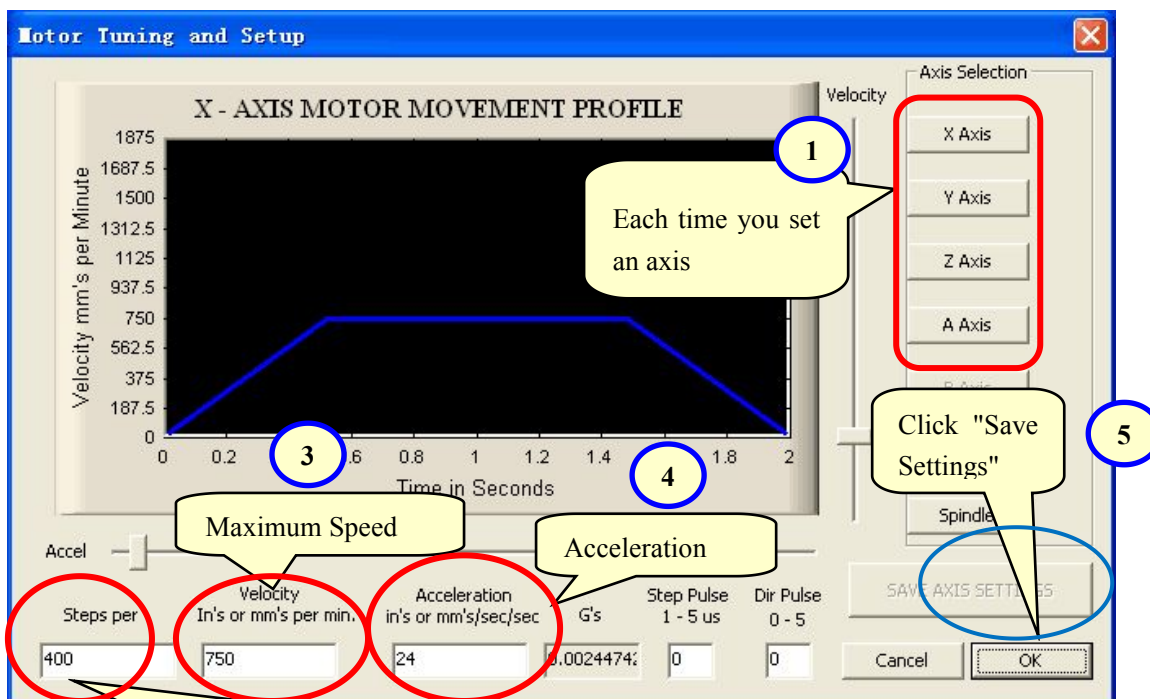
### 1. X, Y, Z, A, B, C-axis output configuration

As shown below: (Config => Ports and Pins)



### 2. Motor parameter settings

As shown below: (Config => Motor Tuning): Set the motor acceleration, velocity, impulse equivalent



Mach3 steps per unit:

Mach3 steps per unit = Mach3 steps per rev \* Motor revs per unit

Axes direction, depends on the "Reversed".

Axis	Revers...	Soft Max	Soft Min	Slow Z...	Home ...	Home ...	Auto Z...	Speed %
X	✗	100.00	-100.00	1.00	0.0000	✓	✓	40
Y	✓	100.00	-100.00	1.00	0.0000	✓	✓	40
Z	✓	100.00	-100.00	1.00	0.0000	✗	✓	20
A	✗	100.00	-100.00	1.00	0.0000	✗	✓	20
B	✗	100.00	-100.00	1.00	0.0000	✗	✓	20
C	✗	100.00	-100.00	1.00	0.0000	✗	✓	20

Entries are in setup units.

G28 home location coordinates:

X: 0 A: 0  
Y: 0 B: 0  
Z: 0 C: 0

OK

### 3. Setup the input singles.

There are 16 general-purpose input channels. The channels number is from 0 to 15(at J4).

Suggest Active Low = "X" (Set High signal Level for Inputs)

Encoder/MPG's			Spindle Setup		Mill Options	
Port Setup and Axis Selection			Motor Outputs	Input Signals	Output Signals	
Signal	Enabled	Port #	Pin Number	Active Low	Emulated	HotKey
X ++	✓	1	4	✓	✗	0
X --	✓	1	4	✓	✗	0
X Home	✓	1	0	✓	✗	0
Y ++	✓	1	4	✓	✗	0
Y --	✓	1	4	✓	✗	0
Y Home	✓	1	1	✓	✗	0
Z ++	✓	1	4	✓	✗	0
Z --	✓	1	4	✓	✗	0
Z Home	✓	1	2	✓	✗	0
A ++	✓	1	4	✓	✗	0

Pins 1 through 16 are available for the input signals. Pins 1 through 16 may be used for the input signals.

Pick ticks "✓"

Enter "1"

from 0 to 15

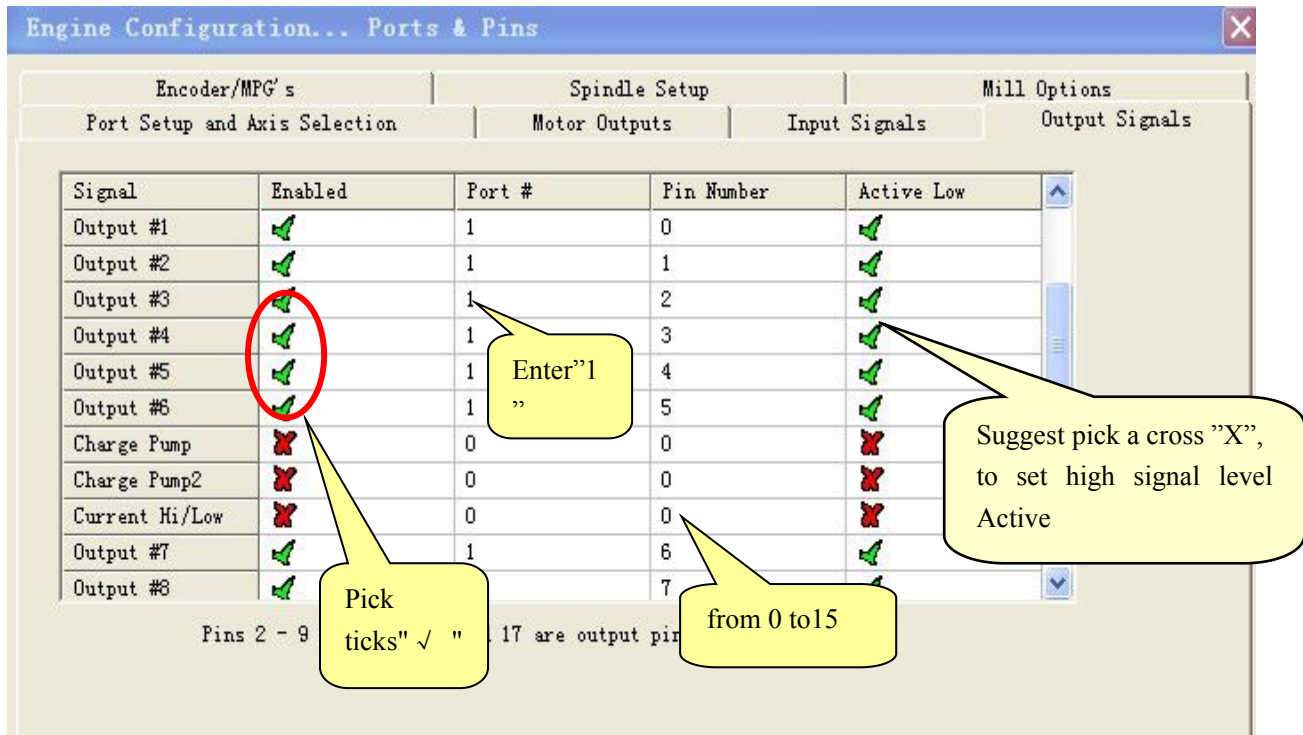
Suggest pick a cross "X", to set high signal level Active

### 4. Setup the Output signals.

There are 8 general-purpose (open-drain) output channels,

The channels number is from 0 to 7 (at J5).

Suggest Active Low = "√" (Set Low signal Level for outputs)



### 3. 6: MACH3 spindle speed settings

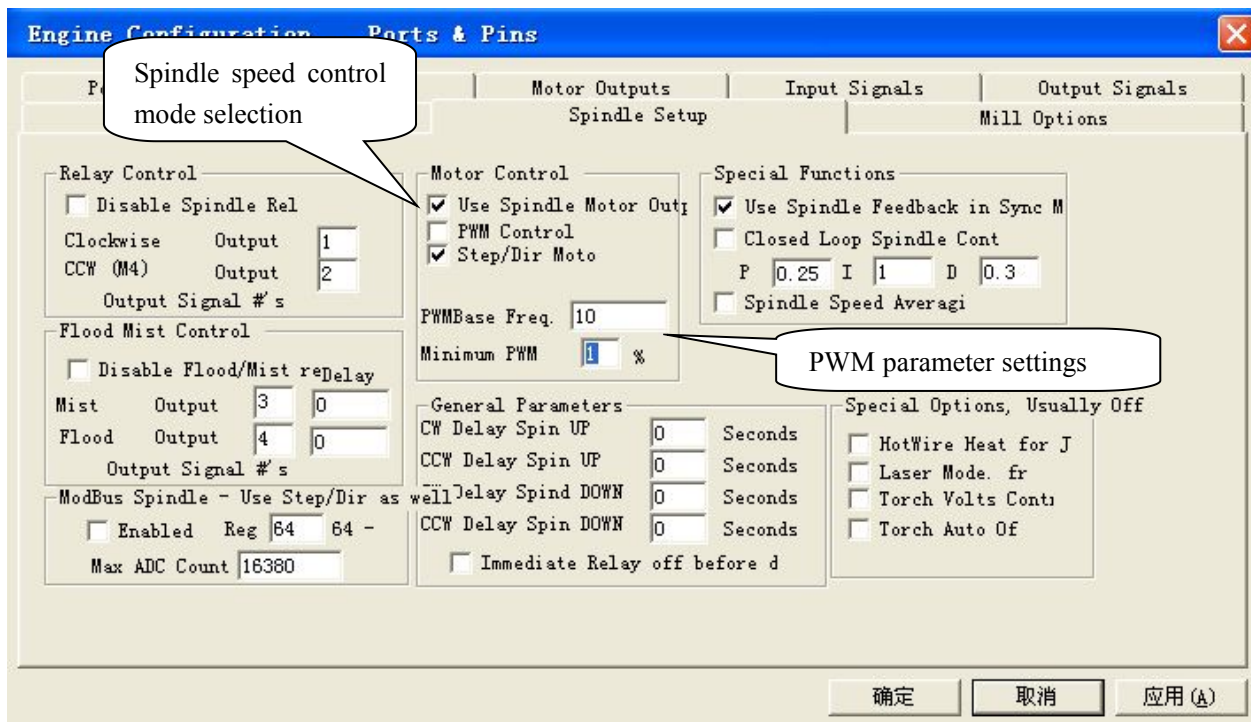
MACH3 motion control card supports the following three kinds of ways Spindle speed control: PWM, pulse + direction, analog voltage 0 to 10V

Refer to the following figure, enter the spindle speed settings window:



Refer to the following figure: the spindle speed adjustment parameter settings:





Parameters setting:

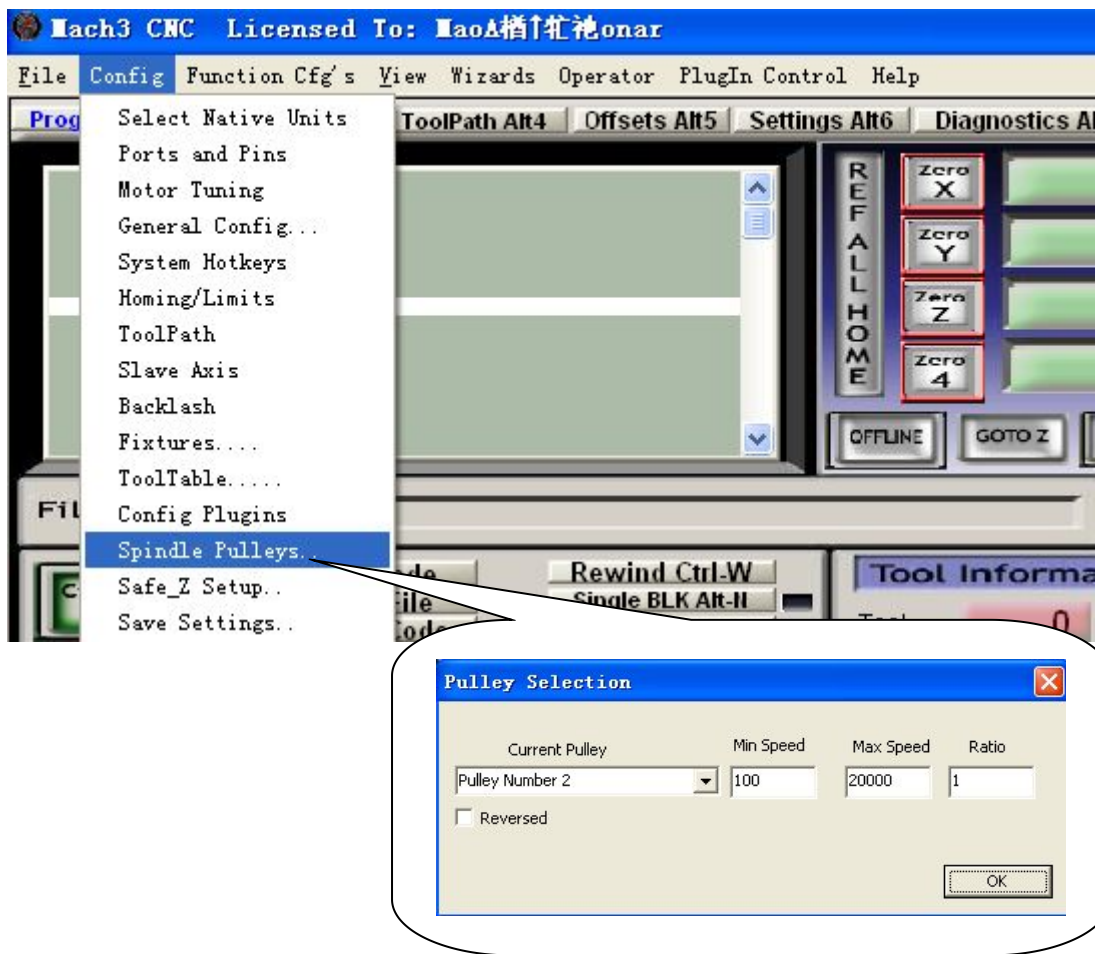
Spindle speed control mode selection:

If the PWM control spindle speed, or use 0 to 10V analog voltage to control the spindle speed, then select the PWM control;

If using stepper + direction control spindle speed, select step / direction motors.

Select Stepper + direction control spindle speed: also need to set the following parameters

Set the minimum and maximum speeds:

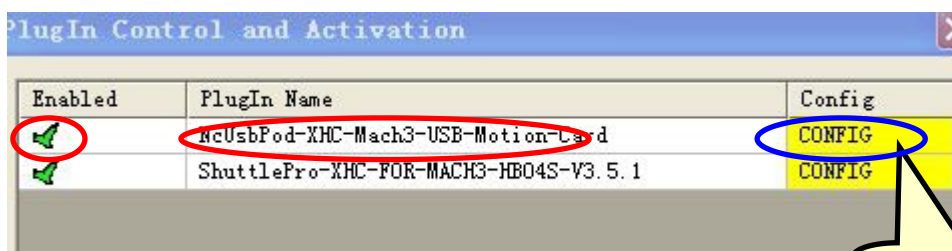


### 3. 7. USB motion control card configuration interface description:

USB motion control card configuration interface, describing the motion control card USB IO port status of the input and output, USB data transfer parameter settings.

Through the following ways to enter USB motion control card configuration interface.

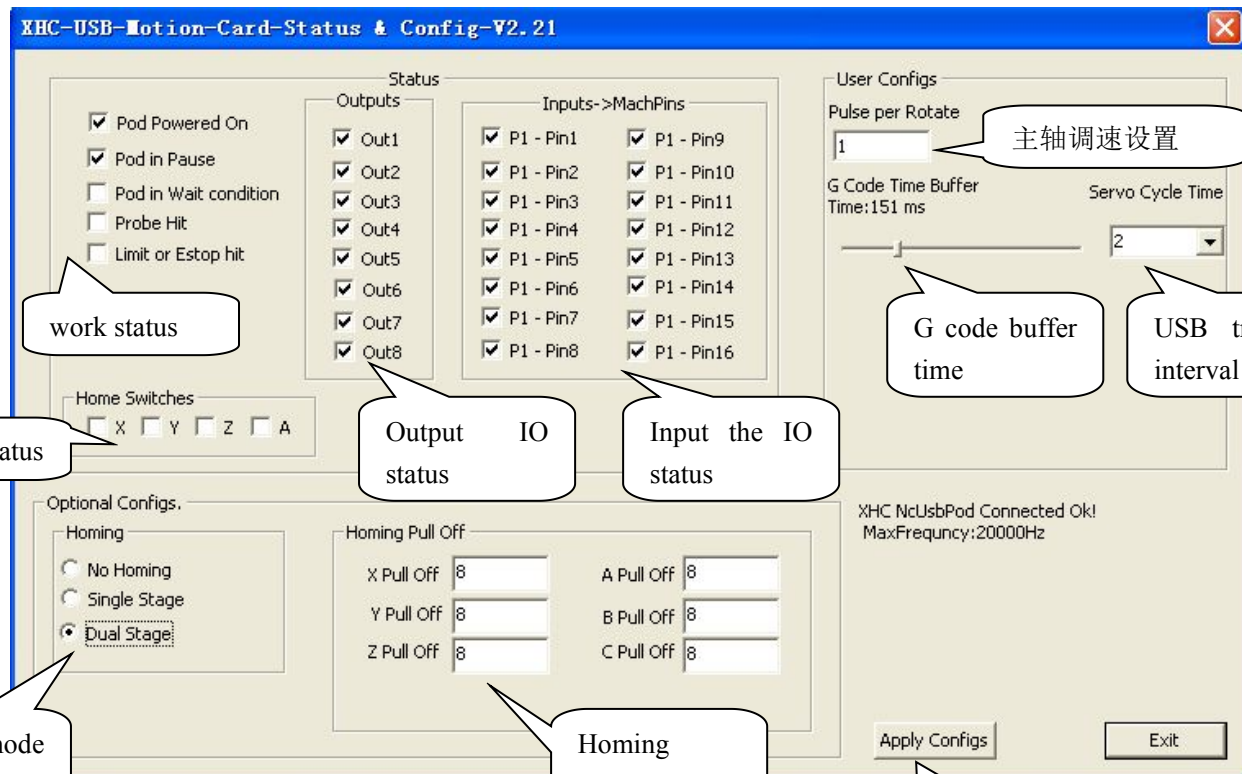
Mach3 Config=>Config Plugins, PlugIn Control and Activation



Click "Config"



configuration interface:



Description of the parameter settings :

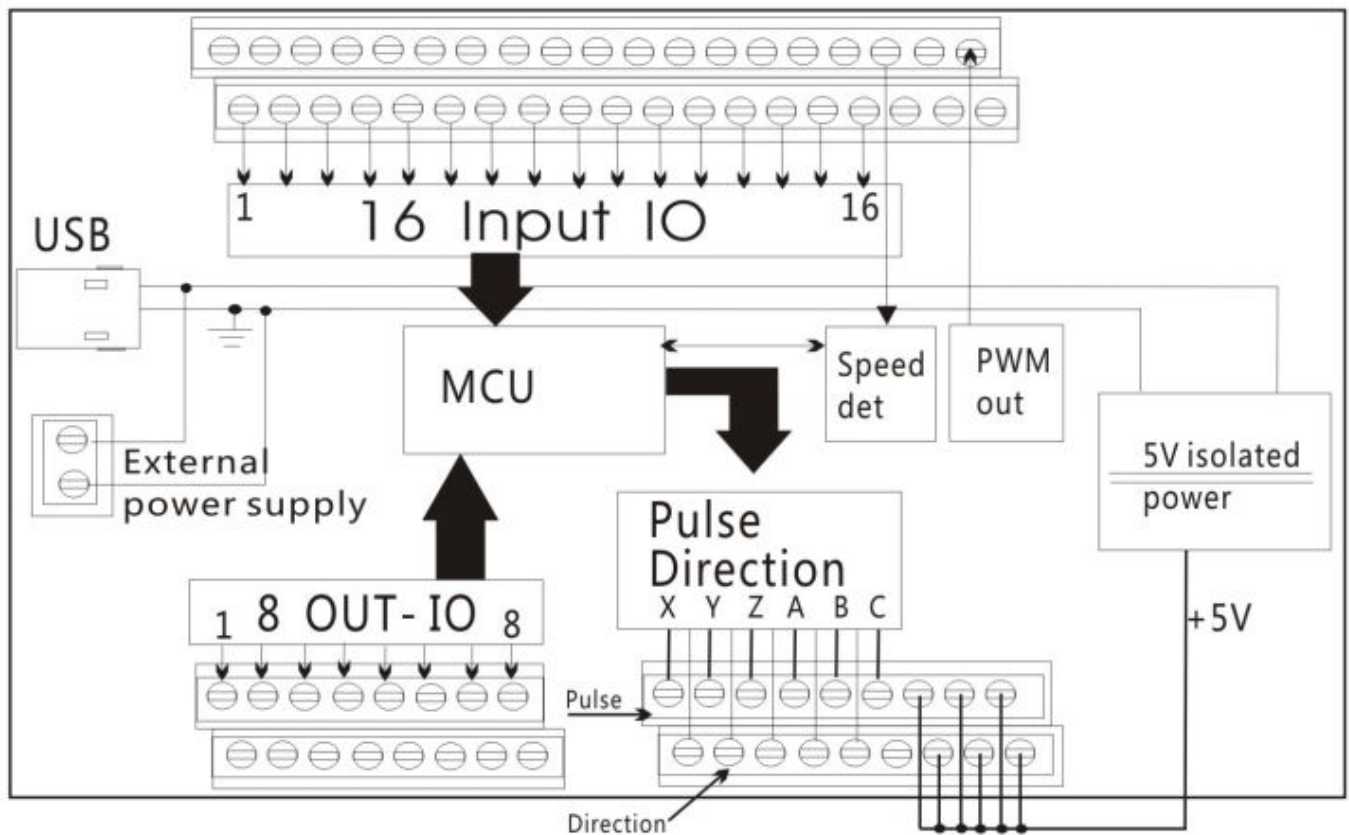
1. Card Work Status: Indicates the current operational status of the card: idle, processing, or limit stop
2. IO output state: When there is motion control card IO input signal or output signal when the show will be in that position
3. Homing Status: Displays the current card is going back to the origin of the X or Y or Z or A axis
4. Homing mode selection: Set the card the way back to the origin  
NO HOMING: Prohibit card homing  
SINGLE STAGE: Single-homing, when this mode is selected, execution back to the origin, then straight back to the home position  
DUAL STAGE: Dual homing, when this mode is selected, the Executing homing, the home position is reached, it will roll back an offset, return to origin
5. Homing Offset settings: When you select DUAL STAGE mode, set the offset back
6. Spindle speed settings: When the spindle speed adjustment mode is selected as pulse + direction, set this parameter indicates that the spindle revolution, the number of pulses required
7. G code buffer time settings: Set G-code buffer time, according to the different PC performance, adjusting this parameter, it will optimize the processing fluency
8. USB transfer interval setting: According to different computer performance, adjusting this parameter, it will optimize the processing fluency



## Motion control card hardware connection and electrical characteristics

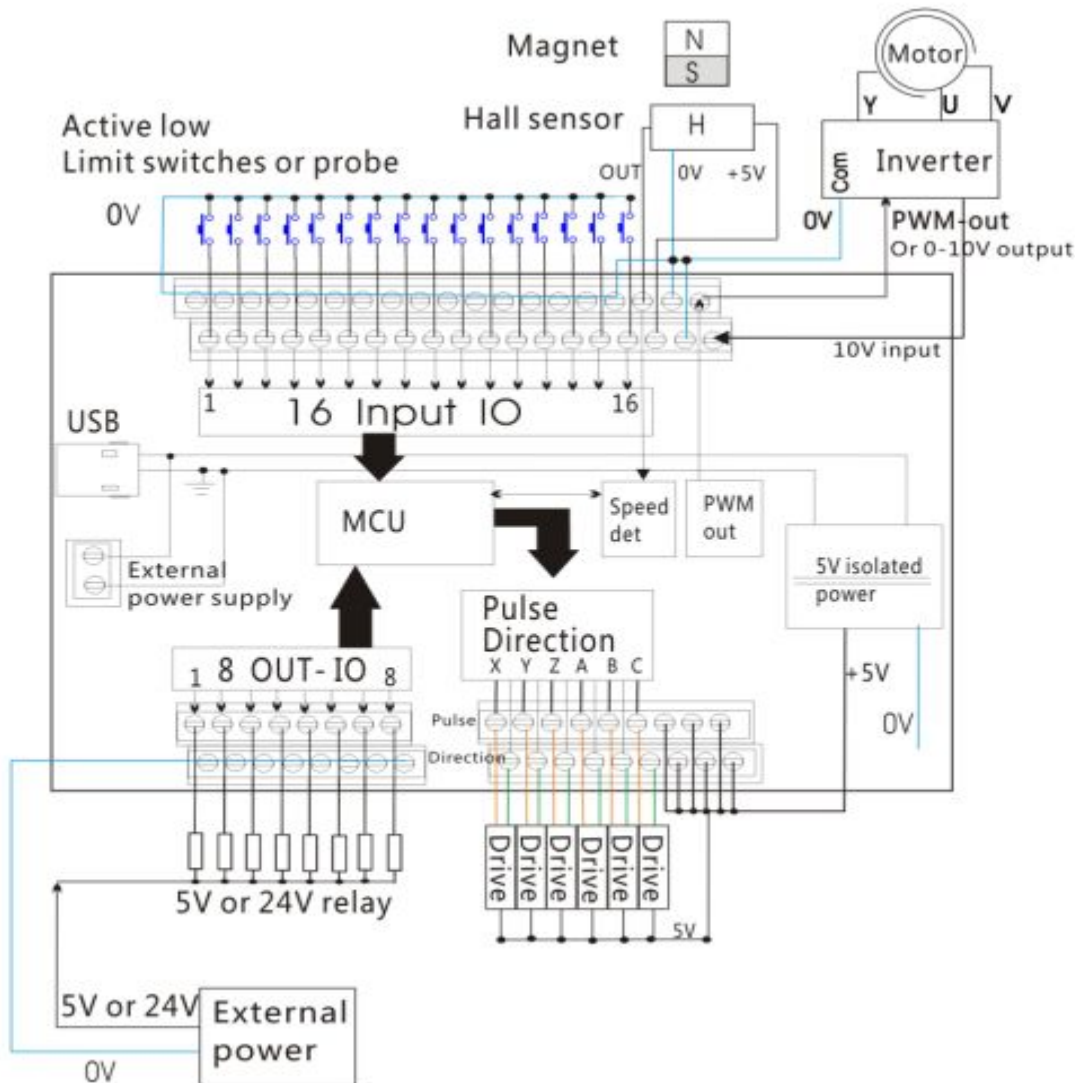
### 1. Block diagram of motion control card

The board is used USB power source, with isolated power source module, external power supply is not requested. All outputs, including 4 axes pulse/DIR/8 output controls/Spindle-speed PWM output, are set to be high-impedance state (Hi-Z) when USB is connected. When running Mach3, Level is controlled by Mach3. Suggest: All output signals in Mach3 can be set to be Active Low.





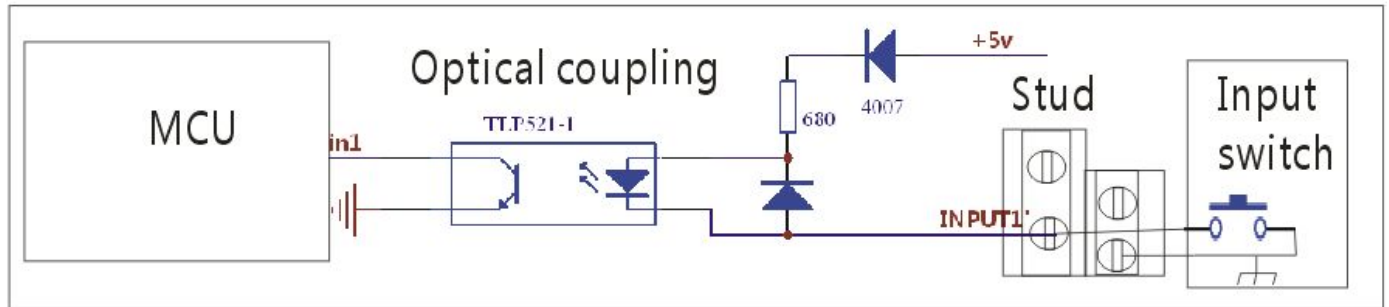
## Motion control card application connection schematic





## Input IO Signal Description

Using isolated input, active low input.



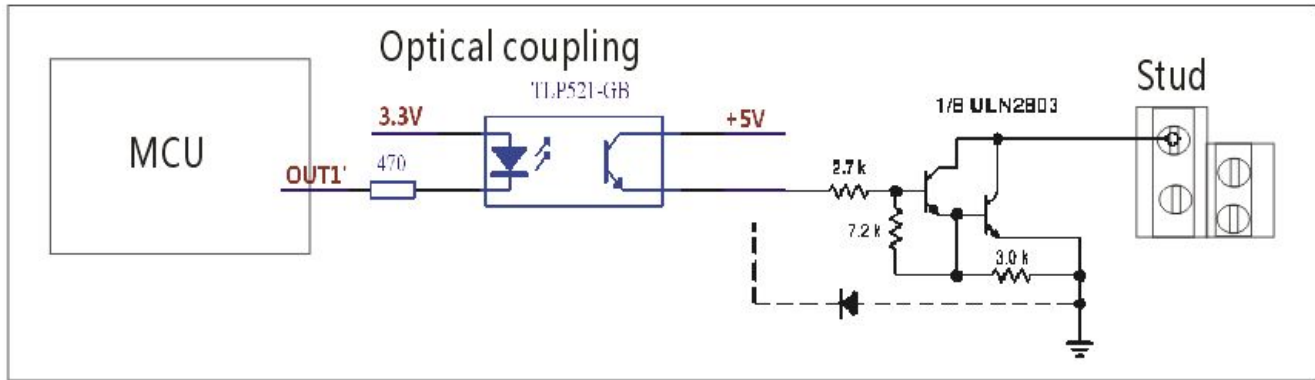
MACH3 configuration table

MACH3-IO	USB Card input terminals	MACH3 configuration capabilities	Input Voltage	Input Current	Input Level
P1.0	IN1	X-axis homing	5V or 24V	5mA	Active low
P1.1	IN2	Y-axis homing	5V or 24V	5mA	Active low
P1.2	IN3	Z-axis homing	5V or 24V	5mA	Active low
P1.3	IN4	A-axis homing	5V or 24V	5mA	Active low
P1.4	IN5	X, Y, Z, A-axis limit	5V or 24V	5mA	Active low
P1.5	IN6	Freely defined	5V or 24V	5mA	Active low
P1.6	IN7	Z-axis height trigger	5V or 24V	5mA	Active low
P1.7	IN8	Emergency Stop	5V or 24V	5mA	Active low
P1.8—P1.15	IN9—IN16	Freely defined	5V or 24V	5mA	Active low



## Output Signal Description

### Schematics



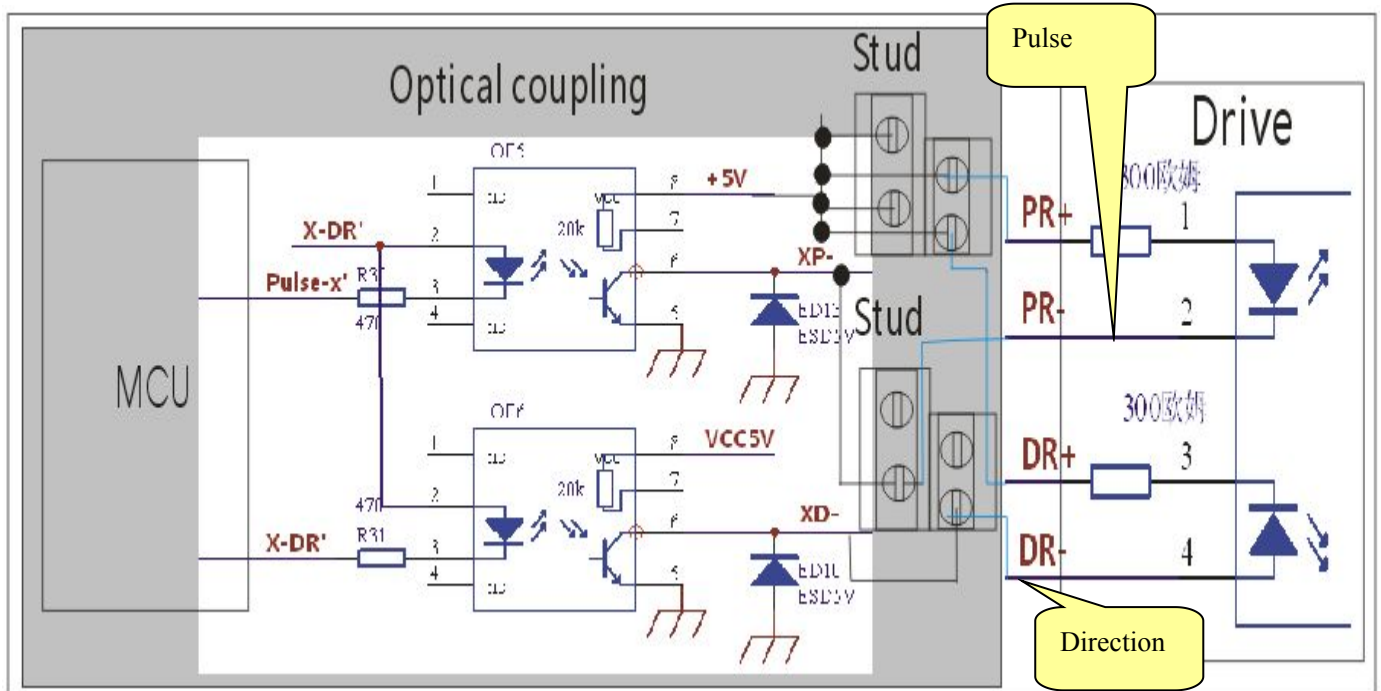
MACH3 configuration table

MACH3- IO	USB Card Terminals	MACH3 configuration capabilities	Output	Output Drive Current	Output Level
OUTPUT#1	OUT1	Spindle Forward	Isolated open collector output	50mA	Active low
OUTPUT#2	OUT2	Spindle CCW	Isolated open collector output	50mA	Active low
OUTPUT#3	OUT3	Coolant ON / OFF	Isolated open collector output	50mA	Active low
OUTPUT#4	OUT4	Cooling gas ON / OFF	Isolated open collector output	50mA	Active low
OUTPUT#5	OUT5	Freely defined	Isolated open collector output	50mA	Active low
OUTPUT#6	OUT6	Freely defined	Isolated open collector output	50mA	Active low
OUTPUT#7	OUT7	Freely defined	Isolated open collector output	50mA	Active low
OUTPUT#8	OUT8	Freely defined	Isolated open collector output	50mA	Active low



## drive signal description

### Schematics



MACH3 configuration table

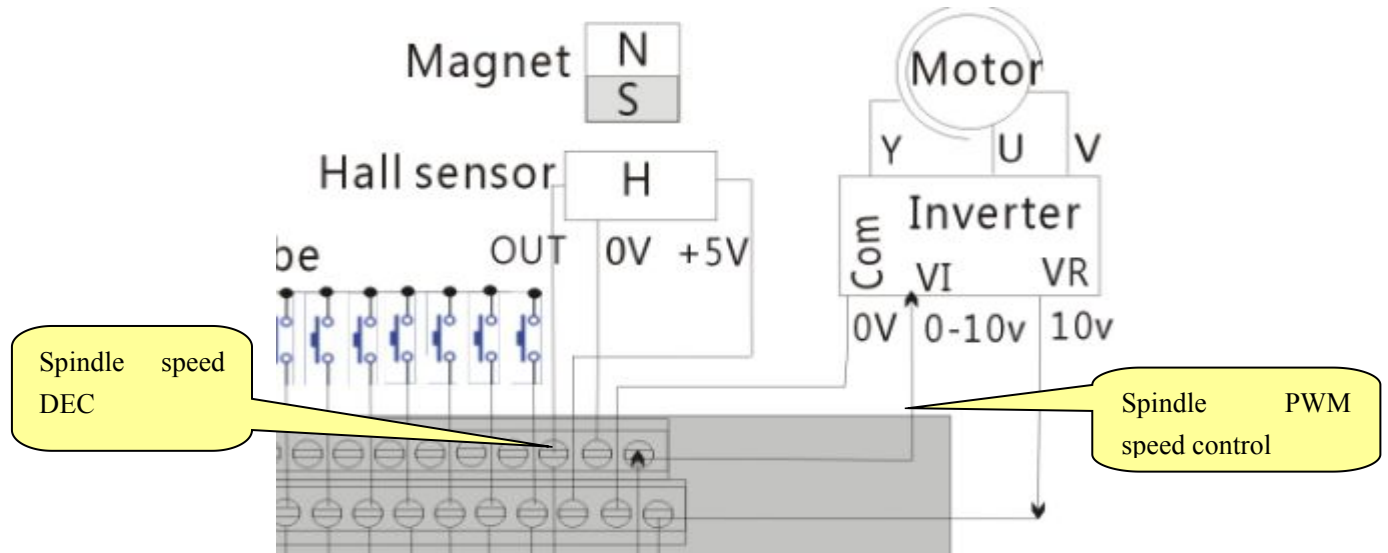
MACH3 configuration	usb terminal	card	Name	Output	Output Drive Current	Output Level
X-axis	XP-		X-axis pulse	Open 5V output isolation	20mA	Active low
	XD-		X-axis direction	Open 5V output isolation	20mA	Active low
Y-axis pulse	YP-		Y-axis pulse	Open 5V output isolation	20mA	Active low
	YD-		Y-axis direction	Open 5V output isolation	20mA	Active low
Z-axis pulse	ZP-		Z-axis pulse	Open 5V output isolation	20mA	Active low
	ZD-		Z-axis direction	Open 5V output isolation	20mA	Active low
A-axis pulse	AP-		A-axis pulse	Open 5V output isolation	20mA	Active low
	AD-		A-axis direction	Open 5V output isolation	20mA	Active low
B-axis pulse	BP-		B-axis pulse	Open 5V output isolation	20mA	Active low
	BD-		B-axis direction	Open 5V output isolation	20mA	Active low
C-axis pulse	CP-		C-axis pulse	Open 5V output isolation	20mA	Active low
	CD-		C-axis direction	Open 5V output isolation	20mA	Active low





## Spindle Speed Signal Description

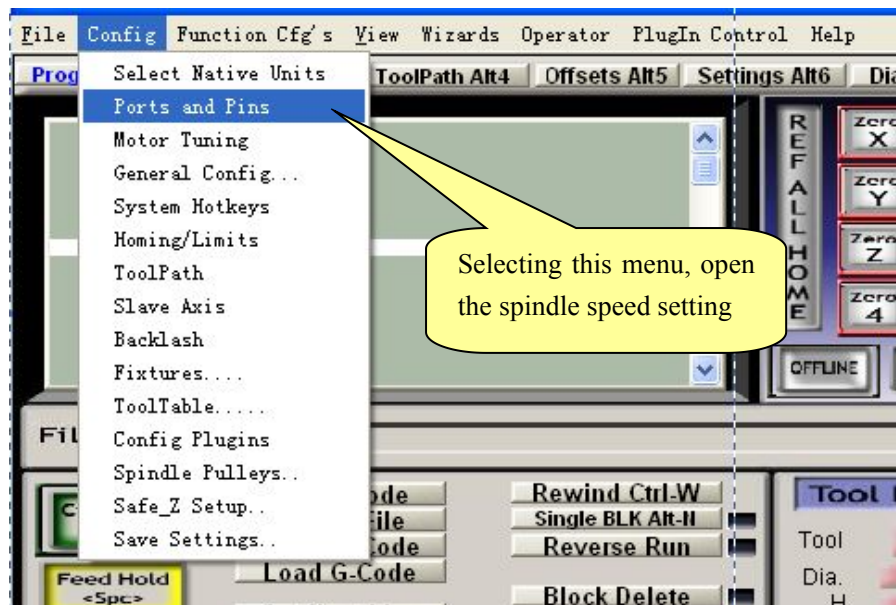
Reference to the control card schematic, the Hall sensor and motion control card connected



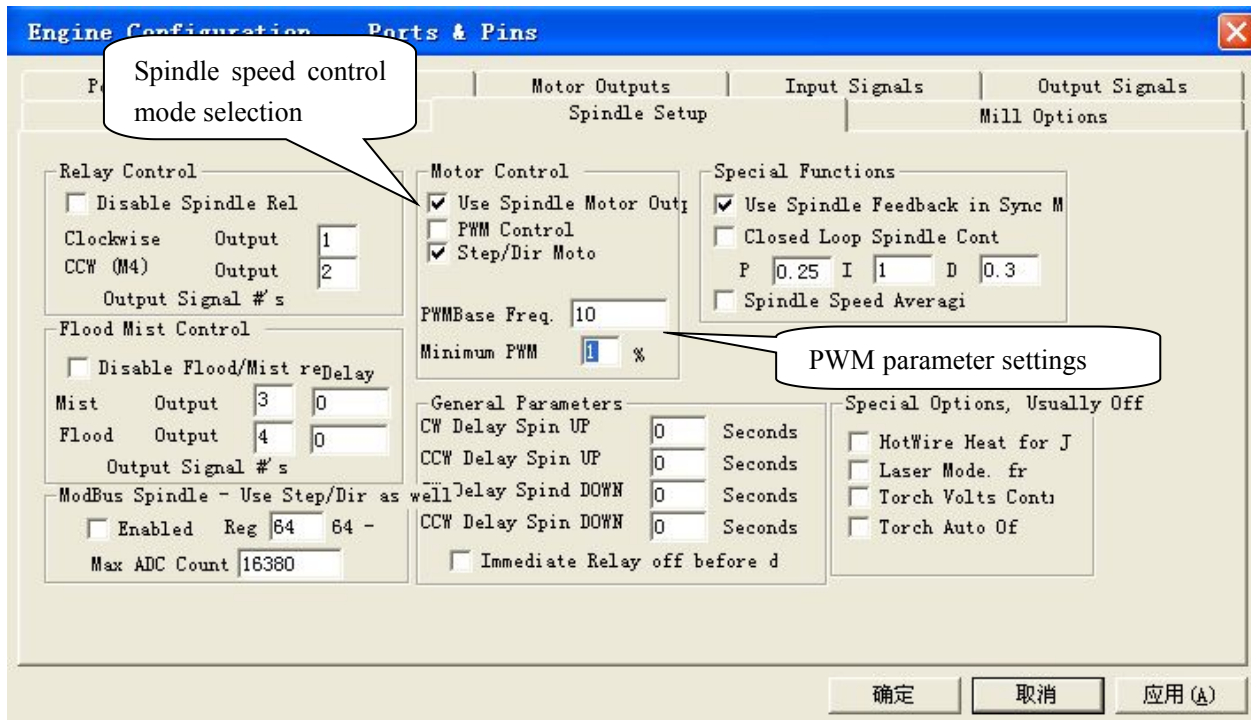
Set the parameters MACH3:

MACH3 motion control card supports the following three kinds of ways Spindle speed control: PWM, pulse + direction, analog voltage 0 to 10V

Refer to the following figure, enter the spindle speed settings window:



Refer to the following figure: the spindle speed adjustment parameter settings:



Parameters setting:

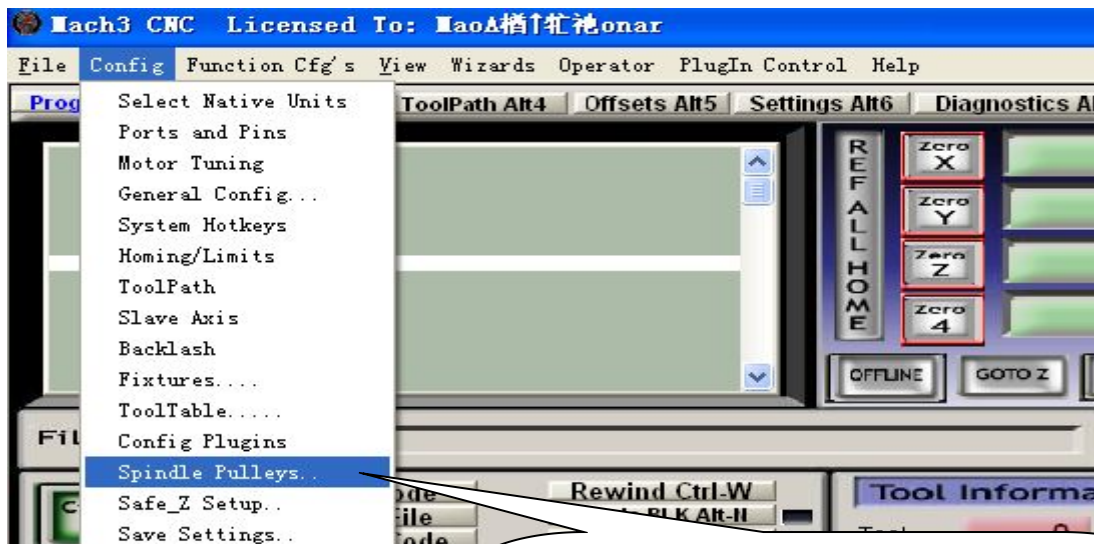
Spindle speed control mode selection::

If the PWM control spindle speed, or use 0 to 10V analog voltage to control the spindle speed, then select the PWM control;

If using stepper + direction control spindle speed, select step / direction motors.

Select Stepper + direction control spindle speed: also need to set the following parameters

Set the minimum and maximum speeds:



#### Pulley Selection

Current Pulley	Min Speed	Max Speed	Ratio
Pulley Number 2	100	20000	1

☐ Reversed